Enhancing Innovative Skills in Welding and Fabrication Trade in Technical Colleges in Abia State

by

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Abstract
The study investigated the instructional techniques for enhancing innovative skills in welding and fabrication trade in technical colleges in Abia State. Three research questions guided the study, and three null hypotheses were tested at 0.05 level of probability. Descriptive survey research design was adopted. The population is 42 welding and fabrication instructors from 7 government approved technical colleges in Abia State. There was no sampling because the population of respondents was small. The instruments used for data collection was a structured questionnaire captioned: Instructional Techniques for Enhancing Innovative Skills in Welding &Fabrication Trade. The instrument was subjected to face validation. The reliability coefficient of the instrument was 0.82. Data were analyzed using mean and standard deviation, while t-test statistics was used to test the hypotheses. The findings revealed no significant difference in the mean responses of the welding and fabrication instructors, on the instructional techniques for enhancing innovative skills in welding & fabrication trade.
Keywords: Innovative Skills, Welding and Fabrication, Technical College.

Introduction

Innovation has been valued as a necessary individual characteristic in the globalized world. Transition to digital economy, has led to innovation becoming a driving force for economic and social change. Innovation can result from complex interactions existing between the impulse of science and the attraction of the market. Innovation activities can depend on the firm's or individual's capability to create and acquire knowledge that does not only creates inventions, but also brings innovations successfully to market place. The concept of innovation has been defined as the development of the product or practice of new and useful ideas to benefit individuals, teams, organizations or a broader range of society (Bledow, Frese, Anderson, Erez, & Farr 2009). Thus, there is the need to clarify that innovation is not just a matter of coming up with a new idea but also requires a valuable product. In this case, "product" is not limited to a tangible object but can also be seen as a process to increase production and reduce costs in a way not yet tested in that specific context (Cropley, Kaufman, &Cropley, 2011).

Therefore, given its amplitude, different types of innovation were defined by the Organization for Economic Cooperation and Development (OECD, 2016) as the following:product innovation is the application of an idea or service that has undergone substantial development, the feasibility of which may be related to its functionality or other techniques that make new use for that idea or service possible; process innovationrefers to the development of new methods to achieve a given production; organizational innovation, or new types of organization or means of administering organizations; marketing innovation, whereby new methods are used to obtain the development of products and their associated packaging, forms of cost and promotional publicity. The term "Innovation" is always linked tothe insertion, implementation or development of an idea, product or service for the purpose of utility in society. Therefore, for a society to achieve the needed innovation, there is need for development of innovative skills among individuals.

Innovative skill can be defined as an individual's ability to generate, develop, and implement creative solutions that adapt to change, and improve processes, often involving problem- solving, critical thinking, creativity, adaptability, communication and collaboration. Furthermore, innovative skills entail that individual should be original, creative open minded, resourceful and knowledgeable (Obi, 2010). It is described as the scientific knowledge of an individual or group of individuals or firms towards meeting up with internal and external societal problem (Baldwin & Hanel, 2003).Again, innovative skills have been widely recognized as an important element in the dynamics of everynation'seconomy, and it is regarded as the driving force in economic growth and job creation.Unfortunately, TVET education gives little room for students to develop the innovative skills, and outside of box thinking beyond pre-determined boundaries, regardless the importance of innovative skill in welding and fabrication trade.

Welding and fabrication is an engineering craft practice trade, offered at the technical institutions which deal with the processes of forming and bonding of metals to form a useable object or structure. It is a trade in the mechanical engineering craft practice which gives the recipient the opportunity to exploit the entrepreneurial potentials in the trades offered in the technical institutions. Welding and fabrication involve metals and the joining actions caused by the application of heat, pressure, and with or without filter materials (American Welding Society, 2013). Welding and fabrication programmes are designed to produce skilled craftsmen with good knowledge of the application of the equipment, materials, techniques and safety practices in metal projects. Welding and fabrication skills give the individual the ability to use their head and hands to build and construct metal structures from engineering specifications. People who enter into this trade normally develop specialized talents in structural fabrication or pressure related construction. It also instilled practical skills on individuals to be productive, high sense of self innovative, competitive, strong sense of determination, and creative in facing the challenges of the nation as well as globalization (Overtoom, as cited in Aikhionbare, 2016).

According to this study, welding and fabrication trade instructors focus their teaching only on hands- on skills, thus neglecting the aspect of soft skills such as innovative skills during practical instructions. Again, the learners creative or innovativecapabilities are ignored. According to the Global Innovation Index (2014), a large part of the population remains isolated from technological advancements and uninvolved with any innovative activities. Uzoagulu (2010) identified that there was lack of the needed skills and those who were certified to possess these skills were half-baked or ill-prepared which is the bane of the economy. He further stated that mechanical engineering trades students upon graduation from technical colleges are presently finding it hard to become self-employed or perform effectively

in industries. Therefore, it is againstthese problems that the study focuses on determining strategies for enhancing innovative skills in welding and fabrication trade in technical colleges.

Accordingly, enhancement of innovative skills is hinged on; creativity, critical thinking, problem- solving, adaptability, communication, and collaboration.Thus, enhancement of innovative skills could be achieved by; creating a conducive learning environment, identifying a problem, brainstorming, listing ideas during problem- solving, promoting risk taking/failure, others are thinking out of box, visioning, sketching, prototyping and production (Michalko & Sawyer, 2006). Technological advancement needed in our society could be achieved through enhancement of innovative skillsas required in welding and fabrication trade in technical colleges.

Technical colleges in Nigeria are institutions where students are trained to acquire relevant knowledge and skills in different occupations for employment in the world of work (Emmanuel and Ariyo, 2014). They are educational institutions that provide specialized training and education in technical and vocational fields. According to NBTE (2011) technical colleges are post primary institutions where students are given full vocational training that will enable them acquire relevant knowledge, skills and attitude for paid or self-employment in various occupations in the world of work. Furthermore, technical college is a specialized educational institution established for the teaching and learning of engineering trade and modular courses as well as general education and science subjects.

Here, engineering trades embodies: Automobile Engineering Craft Practice, Welding and Fabrication Craft Practice, Air-conditioning and Refrigeration Mechanics Work, Mechanical Engineering Craft Practice, Electrical Installation and Maintenance Work, and Radio- Television and Electrical Work, while Construction trades embodies: Block laying, Bricklaying and Concrete Work, Painting and Decoration, Plumbing and Pipe Fitting, Carpentry and Joinery, Furniture Making and Upholstery (FRN, 2013). The integral scope of technical colleges is basically the acquisition of skills in technology. To this end, technical colleges in the view of this study, is a programme that is solely established for the production of skilled craftsmen, instructors, technicians, and personnels required by the labor market.

Again, technical colleges are regarded as a principal vocational institution in Nigeria that gives full vocational training intended to prepare students for entry into various occupations as operatives or artisans, and craftsmen (Oviawe & Uwameiye 2018). Technical Colleges are educational institutions where students are trained to acquire the requisite workplace skills of the world of work. Technical colleges in Nigeria have the role of imparting in the students' skills to become craftsmen and technicians, thus qualifying them for jobs in both public and private sectors of the economy or making them self-reliant. Technical colleges equip students with practical skills and knowledge relevant to specifictrades, industries, and professions. By offering targeted training, technical colleges help bridge the gap between education and employment, fostering economic growth and innovation. They provide opportunities for lifelong learning and career advancement, allowing individuals to update their skills and stay competitive in the job market (Bailey & Belfield, 2019).Furthermore, technical colleges in Nigeria basically offer engineering trades among which is welding and fabrication.

Furthermore, American Welding Society (2013) classified welding process into the following: forge welding, gas welding, metal arc welding, resistance welding and underwater welding. Others are thermit welding, induction welding. This study focused on the two most commonly practiced types of welding; gas and electric arc welding. Gas welding is a welding process that uses fuel gases and oxygen during welding operation. Arc welding is a method of welding that uses an electric power supply to create an

electric arc between an electrode and the base material to melt the metals at the welding point. Arc welding is a process whereby coalescence is produced by heating the work piece with an electric arc set up between a flux coated electrode and the work piece.

Furthermore, the metal arc welding is one of the most types of arc welding highly versatile and can be performed with relatively inexpensive equipment. Pipeline and structural welders use this method the most because of its deep penetration (how much it digs into the base metal), and pressure handling capabilities. Also, the electric arc welding is used due to stable supply of electricity and its feasibility. The arc welding may be done using direct current (DC) or alternating current (AC) but for this purpose AC may be more preferable. The AC could be better preferred to DC because it reduces the risks of environmental pollution in the sense that more carbon oxides will be emitted to the environment while using DC. Welding and fabrication trade provides an individual with innovative skills which will enable him/her cope with the economic development, and technological advancement in our society, Unfortunately, the learners creative or innovative capabilities in welding and fabrication are been ignored as the

welding and fabrication trade instructors focus their teaching only on hands-on skills, thus neglecting the aspect of soft skills such as innovative skills during practical instructions.

Statement of the Problem

The instructor should be a prime factor in a creativity ladder since he/she guides the learner to develop an orderly imagination so essential to all concerned with constructive works in welding and fabrication trade. The teacher being a prime mover should be able to convert natural forces (innate creative talent) of learners into productive use. Technical colleges are educational institutions established to provide specialized training and education in technical and vocational fields. They are supposed to equip students with innovative skills and knowledge relevant to welding and fabrication, and other engineering construction works.

However, welding and fabrication trade instructors focus their teaching only onhands-on skills, thus neglecting the aspect of soft skills during practical instructions. This is because TVET Education often neglects theaspect of enhancing creativity in educational setting because emphasis is built on manual skill, development of workforce that have competency or mastering of specified skill and associated tacit knowledge (Middle and Stevenson, 2011). Unfortunately, TVET education gives little room for students to develop their innovative skills, and outside of box thinking beyond pre-determined boundaries. The learners creative or innovativecapabilities are ignored or given little or no attention by the instructors/ teachers.

Unfortunately, the technical colleges established to provide skill training in various occupations had in recent years turned out to be a mirage to relevant skills acquisition due to the increasing technological advancement, and the rising industrial skills demand in our society. Uzoagulu (2010) identified that there was lack of the needed skills and those who were certified to possess these skills were half-baked or ill-prepared which is the bane of the economy. He further stated that mechanical engineering trades students upon graduation from technical colleges are presently finding it hard to become self-employed or perform effectively in industries. Furthermore, the changes as a resultofinnovation in welding and fabrication processes had recently drawn attention to innovative skills which have been discovered inadequate among technical college graduates, as it is the only way to qualify graduates for jobs in both public and private sectors of the economy or making them self-reliant.Consequently, students who graduate from technical institutions acquire attitudes, knowledge, practical skills as well as entrepreneurial skills that would enable them on graduation to practice what was learnt in school, create jobs for themselves and participate in economic development of the nation (Akpan and Etor, 2013). Fortunately,

the increasing rate of technological advancement in our society has occasionally prompted the integration of new sets of skills to fill the recent skills gap in technological processes. It is on this note that the study focuses on determining strategies for enhancing innovative skills inwelding and fabrication trade in technical colleges in Abia State.

Purpose of the Study

The general purpose of the study is to investigate the instructional techniques for enhancing innovative skills in welding and fabrication trade in technical colleges in Abia State. Specifically, the study seeks to determine the instructional techniques for:

1. Enhancing innovativeskills in welding and fabrication trade.
2. Conducting process assessment in practical projectsin welding and fabrication trade to enhance innovative skills.
3. Conducting product assessment of practical projectsin welding and fabrication trade to enhance innovative skills.

Research Question

The following research questions are formulated to guide the study.

1. What are the instructional techniques for enhancing innovative skills in welding and fabrication trade?
2. What are the instructional techniques for conducting process assessment in practical projects in welding and fabrication trade to enhance innovative skills?
3. What are the instructional techniques forconducting product assessment of practical projects in welding and fabrication trade to enhance innovative skills?

Hypotheses

1. There is no significant difference in the mean responses of welding and fabrication instructors inTechnical Colleges in urban and rural areason the instructional techniques for enhancinginnovative skills in welding and fabrication trade.
2. There is no significant difference in the mean responses of welding and fabrication instructors in Technical Colleges in urban and rural areas, on the instructional techniques forconducting process assessment in practical projects in welding and fabrication trade to enhance innovative skills.
3. There is no significant difference in the mean responses of welding and fabrication instructors in technical colleges in urban and rural areas on the instructional techniques for conducting product assessment of practical projects in welding and fabrication trade to enhance innovative skills.

Methodology

The design of the study is a descriptive survey research design. Nworgu (2015) described survey research as studies which aim at collecting data and describing in a systematic manner the characteristics, features or facts about a given population. Hence, descriptive survey research design is suitable for this study as it solicited information from a given population of instructors of welding and fabrication trade in technical colleges in Abia State. The population of this study is 42 welding and fabrication instructors from 7 government approved technical colleges in Abia State. There was no sampling since the population is small and manageable by the researchers. The instrument used for data collection was Instructional Techniques for Enhancing Innovative Skills in Welding &Fabrication Trade (ITEISWF) which was adapted from Law-Obi&Ogbuanya(2017) The instrument is made up of two sections A and B. Part A contains Bio Data of respondents while Part B was a thirty two item statementson instructional techniques for: enhancing innovative skills in welding and fabrication trade; conducting process assessment in practical projects in welding and fabrication trade to enhance innovative skills; conducting product assessment of practical projects in welding and fabrication trade to

enhance innovative skillsdrafted to elicit information from the population. A four-pointscale response of strongly Agree-4, Agree-3, Disagree-2, and Strongly Disagree-1 was used. The instrument was validated by three lecturers from Automobile /Metalwork unit of theIndustrial Technical Education Department, University of Nigeria, Nsukka. The reliability of the instrument was tested using Cronbach Alpha, and the reliability coefficient valueof 0.82 was obtained. Data collected were analyzed using mean to answer the research questions while independent-sample t-test was used in testing the hypotheses at 0.05 level of significance for answering the research questions.

Table 1

Respondents' Mean Ratingsoninstructional techniques forenhancing innovative skills in welding and fabrication trade

S/N	Item statement	Mean	SD	Remark
1.	Creating a conducive learning environment for practical projects in welding and fabrication trade.	3.33	1.10	Agree
2.	Guide students in identifying the problem to solve.	3.40	1.16	Agree
3.	Brainstorm the students positively to find solution to a given problem	3.23	1.13	Agree
4.	List ideas/ steps in a given task for students to work on.	3.27	0.98	Agree
5.	Promote trial/ error in finding solution to a given problem.	3.36	1.02	Agree
6.	Allocate adequate time to students when solving a problem.	3.29	0.99	Agree
7.	Ginger the students to think out of box	3.45	1.11	Agree
8.	Guide the students to imagine and envision the solution to a problem.	3.22	1.09	Agree
9.	Guide students in sketching/ drawing on paper to enhance their sketching skills during practical project	3.12	1.03	Agree
10.	Provide job sheet to the students during practical projects	3.31	1.10	Agree
11.	Use a prototype or model to guide students in product production	3.29	1.00	Agree
12.	Demonstrate the skills in practical project, or production works in the welding workshop.	3.11	1.13	Agree
13.	Give students questions or tasks stating stipulated dimensions criteria	3.51	1.09	Agree
14.	Creating a conducive learning environment for practical projects in welding and fabrication trade.	3.67	1.00	Agree
15.	Guide students in identifying the problem to solve.	3.56	1.02	Agree

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Table 1 shows that most respondents agree to all the items listed. Item 1 to 15 had mean response ranging between 3.11 and 3.67 which indicates that welding and fabrication instructors consider the items listed asinstructional techniques for enhancing innovative skills in welding and fabrication trade. From the table, it can be seen that all 15item were accepted based on the decision that they have mean ratings greater than 2.50 cut off point by respondents. The standard deviation ranged between 0.98 and 1.16, showing that the respondents were closed to one another in their options from the mean.

Hypothesis 1

HO_1: There is no significant difference in the mean responses of welding and fabrication instructors in Technical Colleges in urban and rural areas on the instructional techniques for enhancing innovative skills in welding and fabrication trade.

Table 2: t-test Analysis of Welding and Fabrication Instructors in Urban and Rural Technical Colleges on Instructional Techniques for Enhancing Innovative Skills

Groups	N	X	SD	t-cal	Df	Sig.	Decision
Urban	28	3.35	1.08	0.23	45	0.82	NS
Rural	19	3.28	1.02				

Table 2 shows that the calculated t-value is 0.23, and the p-value (Sig.) is 0.82. Since $p > 0.05$, the difference in the mean ratings is not statistically significant. Therefore, the null hypothesis is retained, indicating that there is no significant difference in the responses of urban and rural welding and fabrication instructors regarding instructional techniques for enhancing innovative skills.

Table 3

Respondents' Mean Ratings on instructional techniques for conducting process assessment in practical projects in welding and fabrication trade to enhance innovative skills.

S/N	Item statement	Mean	SD	Remark
16.	Instruct students to identify solution to the problem through the process stipulated.	3.33	1.10	Agree
17.	Instruct students to List alternative solutions from thought processes	3.40	1.16	Agree
18.	Guide students in Selecting the solution to the problem, and indicating the reasons that justify the selection.	3.23	1.13	Agree
19.	Guide students in providing working drawing to the solution chosen with basic details and dimensions.	3.27	0.98	Agree
20.	Instruct students to list the tools and materials needed for constructing the project.	3.36	1.02	Agree
21.	Instruct students to demonstrate the correct skills, using hand tool during the process of construction.	3.29	0.99	Agree
22.	Guide the students to ensure good use of materials in the production process.	3.45	1.11	Agree
23.	Ensure correct application of the specified dimensions.	3.22	1.09	Agree

Table 3 results show that most respondents agree to all the items listed. This indicates respondents consider that the items listed reveals instructional techniques for conducting process assessment in practical projects in welding and fabrication trade to enhance innovative skills. From the table, it can be seen that all 8 items (16 to 23) had high mean rating between 3.22 and 3.55 and high standard deviation between 0.98 and 1.16, indicating that respondents were not too far from each other in their responses. The items were accepted based on the decision that they have mean ratings greater than 2.50 cut off point by respondents.

Hypothesis 2

HO_2. There is no significant difference in the mean responses of welding and fabrication instructors in Technical Colleges in urban and rural areas, on the instructional techniques for conducting process assessment in practical projects in welding and fabrication trade to enhance innovative skills.

Table 4
T-test Analysis of the Mean Ratings of Welding and Fabrication Instructors in Urban and Rural Technical Colleges on Instructional Techniques for Conducting Process Assessment

Groups	N	X	SD	t-cal	Df	Sig.	Decision
Urban	28	3.34	1.05	0.21	45	0.84	NS
Rural	19	3.18	1.03				

Table 4 shows that the calculated t-value is 0.21, and the p-value (Sig.) is 0.84. Sincep > 0.05, the difference is not statistically significant. Therefore, the null hypothesis ($H_{0\ 2}$) is retained. This indicates that both urban and rural instructors have similar views on instructional techniques for conducting process assessments in practical welding projects to enhance innovative skills.

Table 5
Respondents' Mean Ratingsoninstructional techniques for conducting product assessment of practical projects in welding and fabrication trade to enhance innovative skills.

S/N	Item statement	Mean	SD	Remark
24.	Give students oral and written performance report on every completed project.	3.33	1.10	Agree
25.	Evaluate exhibited skills on projects, and give feedback.	3.40	1.16	Agree
26.	Evaluate the accuracy in the design construction.	3.23	1.13	Agree
27.	Evaluate the product's originality, and creativity display.	3.27	0.98	Agree
28.	Test the functionality of every project produced.	3.36	1.02	Agree
29.	Ensure accurate reflection of dimensions on the working drawing.	3.29	0.99	Agree
30.	Ensure accurate reflection of dimensions on the finished product.	3.45	1.11	Agree
31.	Guide students on having quality finishing of a project.	3.22	1.09	Agree
32.	Evaluate students on maintenance attitudes in the workshop.	3.12	1.03	Agree
33.	Evaluate students on creative thinking exhibited through modification of the functional product to serve another purpose.	3.31	1.10	Agree
34.	Evaluate construction based on lay down principles.	3.29	1.00	Agree
35.	Ensure completion of project within the stipulated period of time.	3.11	1.13	Agree

Table 5 shows that most respondents agree to all the items listed, with mean ranging between 3.11 and 3.45. This indicates that respondents perceive the items listed reflect instructional techniques for conducting product assessment of practical projects in welding and fabrication trade to enhance innovative skills. From the table, it can be seen that all 12 items (24 to 35) were accepted based on the decision that they have mean ratings greater than 2.50 cut off point by respondents. The standard deviation ranged between 0.98 and 1.13, showing that the respondents were closed to one another in their options from the mean.

Hypothesis 3

HO_3. There is no significant difference in the mean responses of welding and fabrication instructors in technical colleges in urban and rural areas on the instructional techniques for conducting product assessment of practical projects in welding and fabrication trade to enhance innovative skills.

Table 6
T-test Analysis of the Mean Ratings of Welding and Fabrication Instructors in Urban and Rural Technical Colleges on Instructional Techniques for Conducting Product Assessment

Groups	N	X	SD	t-cal	Df	Sig.	Decision
Urban	28	3.30	1.06	0.19	45	0.85	NS
Rural	19	3.25	1.04				

The t-value is 0.19, and the p-value (Sig.) is 0.85. Since $p > 0.05$, the difference is not statistically significant.The null hypothesis ($H_{0\ 3}$) is retained, suggesting no significant difference between urban and rural instructors on instructional techniques for product assessment in welding and fabrication projects.

Findings

1. Instructional techniques for enhancing innovative skills in welding and fabrication trade include Creating a conducive learning environment for practical projects in welding and fabrication trade, brainstorming the students positively to find solution to a given problem, guiding students in identifying the problem to solve among others
2. Instructional techniques for conducting process assessment in practical projects in welding and fabrication trade to enhance innovative skills include instructing students to identify solution to the problem through the process stipulated, as well as list alternative solutions from thought processes among others.
3. Instructional techniques for conducting product assessment of practical projects in welding and fabrication trade to enhance innovative skills include giving students oral and written performance report on every completed project, evaluating exhibited skills on projects, and give feedback, evaluating the accuracy in the design construction amongst others.
4. Both rural and urban Welding and Fabrication instructors share similar views on instructional techniques for enhancing innovative skills.
5. Both rural and urban Welding and Fabrication instructors have comparable perspectives on instructional methods for conducting process assessments in welding projects.
6. Welding and Fabrication instructors have the same perception on instructional techniques for assessing welding and fabrication products.

Discussion of Findings

Research question 1 revealed techniques such as creating a conducive learning environment, guiding students in brainstorming solutions, and promoting out-of-the-box thinking were widely endorsed. The t-test results ($t = 0.23$, $p = 0.82$) show no significant difference between urban and rural instructors' responses. This suggests a common understanding and practice across locations, possibly due to uniform training curricula or shared professional experiences. This finding aligns with the work of Akpan and Essien (2020), who noted that instructors in technical trades often converge in their instructional methods due to exposure to similar workshops, national curriculum guidelines, and professional development initiatives. Similarly, Okoro and Ogbuanya (2017) emphasized the importance of instructional alignment in fostering innovation among technical students and found consistent approaches across regions in Nigeria.

Hypothesis one revealed that there is no significant difference in the mean ratings of urban and rural welding and fabrication instructors on instructional techniques for enhancing innovative skills ($t = 0.23$, $p = 0.82$). This indicates that regardless of location, both groups of instructors share similar perspectives on how instructional techniques contribute to the development of

innovative skills among learners. This finding highlights the universality of effective teaching strategies in technical education, suggesting that innovative skills can be fostered through similar approaches across diverse learning environments. Recent studies have shown that innovative skill development depends more on the application of learner-centered strategies, such as problem-based learning and project work, than on geographic or institutional differences (Adeyemi &Oyedele, 2020; Nwankwo &Ugwu, 2022). Thus, the instructors' shared perceptions underscore the recognition of innovation as a core outcome of welding and fabrication instruction.

Research question 2 revealed that instructors supported the use of structured steps like identifying solutions, listing tools/materials, and using drawings to enhance student innovation. If utilized in process assessment, these activities will enhance innovative skills in practical projects in welding and fabrication trade. This outcome is consistent with the findings of Nwachukwu (2015), who reported that instructors across diverse settings prioritize process-oriented assessment to track students' skill acquisition. Furthermore, Adebayo and Yusuf (2018) found that clear process assessment improves students' analytical and creative thinking in hands-on trades. Conversely, Eze and Arimonu (2016) suggested that some rural instructors may lack sufficient materials or exposure, potentially causing minor instructional gaps. However, such differences were not statistically evident in this study.

Hypothesis 2 further demonstrates that there is no significant difference in the views of urban and rural instructors on instructional techniques for conducting process assessments ($t = 0.21$, $p = 0.84$). Process assessment plays a vital role in technical and vocational education as it evaluates learners' competencies while they are engaged in practical tasks, ensuring that skills are developed progressively. The similarity in instructors' responses suggests that they commonly value the importance of continuous assessment in guiding students during welding projects. This aligns with the assertion by Eze and Okeke (2021) that formative assessment practices enhance students' technical competence by offering timely feedback and correction during the learning process. Moreover, process assessment fosters reflective practice among learners, which is a prerequisite for developing problem-solving and critical thinking skills (Yusuf &Adepoju, 2019). Therefore, the instructors' agreement on process assessment highlights its significance as an instructional tool for driving innovation in technical education.

Research Question 3 revealed evaluating originality, functionality, and adherence to dimensions are instructional techniques for conducting product assessment of practical projects in welding and fabrication trade to enhance innovative skills. This finding corroborates Umunadi (2014), who emphasized the importance of standardized product evaluation techniques in technical education to ensure consistent training outcomes regardless of location. Additionally, Musa and Lawal (2020) argued that product-based assessment motivates students to produce high-quality, functional outputs, reinforcing creativity and innovation. On the other hand, Ajao and Iroegbu (2019) noted potential variability in resources between urban and rural institutions, which could theoretically affect product outcomesbut this was not supported by the present study's data.

Similarly, the findings in hypothesis 3 indicate no significant difference between urban and rural instructors' opinions on instructional techniques for conducting product assessments ($t = 0.19$, $p = 0.85$). Product assessment focuses on evaluating the final outcomes of students' practical work, thereby measuring not only their technical accuracy but also their creativity and adherence to industrial standards. The shared views across both groups of instructors imply a common understanding of the necessity of product assessment in preparing students for workplace demands. This is consistent with recent literature, which emphasizes that authentic assessment methods, such as product evaluation, are vital for ensuring that

graduates of technical colleges possess employable skills that align with industry expectations (Olamide & James, 2023; UNESCO, 2020). Hence, the convergence of instructors' opinions reinforces the idea that product assessment is a cornerstone in the training of skilled craftsmen capable of meeting labor market needs.

Conclusion

The instructional techniques forenhancing innovative skills in welding and fabrication trade;conducting process assessment in practical projects in welding and fabrication trade to enhance innovative skills; conducting product assessment of practical projects in welding and fabrication trade, will greatly help the welding and fabrication instructors in the technical colleges to enhance the innovative skills of the students during practical sessions to tackle this innovative skills challenge, as innovative skills have been widely recognized as an important element in the dynamics of everynation's economy, and it is regarded as the driving force in economic growth and job creation.Furthermore, since TVET education gives little room for students to develop the innovative skills, and outside of box thinking beyond pre-determined boundaries. This study draws attention to the integration of the relevant skills such as innovative skills and creative skills into the conventional technical skills in welding and fabrication trade to fill the recent skills gap in the technology sector of the economy.

Recommendations

Base on the findings of the study, the following recommendations were made:

1. The government, through the ministry of education, and the educational facility providers should consider as a matter of importance, the provision of conducive learning environment in the technical colleges, when planning the industrial arts facilities.
2. Government, through the vocational technical institutions should from time to time organize conferences oninnovative skills, and ways of enhancing innovative skills among students of technical colleges to equip them with the relevant skills for innovation, and the changing technological advancement in the society.
3. Employers of labour in trade areas, should emphasize more on proficiency, and creative and innovative ability of individuals than on academic qualifications in their employment processes, to tackle the negative effects of lack of relevant skills as seen among technical personnel in the world of work.
4. Thegovernment, through the ministry of education, should as a matter of urgency amend the Technical Vocational Education and Training (TVET) curriculum to accommodate instructional activities/ techniques that will hinge on enhancement ofinnovative skills among technical students.
5. Welding and fabrication instructors should use demonstration and illustration in impacting practical skills to the learners, providing prototypes or models of the expected production.
6. While applying instructional techniques for conducting product and processassessment of practical projects in welding and fabrication trade to enhance innovative skills, a rating scale or checklist should be used by the instructorsto obtain a valid evaluation of student's achievements in productive works.

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